NOTES ON SOME FOSSIL PLANTS FROM THE TRINITY DIVISION OF THE COMANCHE SERIES OF TEXAS.

BY

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(With Plates XXXVI-XLIII.)

The fossil plants whose description form the subject of this paper were collected by their discoverer, Mr. J. W. Harvey, of Glen Rose, Texas. They occur in the bed of the Paluxy River, two miles above Glen Rose. The material containing the fossils is a pretty firm limestone, quite free from sand and clay, and light gray in color, which was evidently a deposit formed at a considerable distance from the shore. This necessitated a prolonged immersion of the plant remains in water and their transportation over long distances. This conclusion, drawn from the nature of the sediment, is confirmed by the condition and character of the plant fossils. They are very fragmentary, and consist chiefly of types that can withstand maceration. The fact that the plant remains probably did not obtain speedy entombment in sediments must be taken into consideration in determining the probable character of the flora of the Trinity epoch, for the absence of certain types may be accounted for by the conditions attending the fossilization of vegetation.

The limestone is without minor structure planes and cleavage. It breaks in any direction, and this fact makes it difficult to work out, without additional comminution, the fragments preserved. An additional difficulty in securing identifiable specimens is caused by the fact that the vegetable matter of the fossils in many cases peals off from the stone, leaving an imprint that does not always give the true character of the relic.

Most of the fossils are in the form of small fragments. Cones of conifers and bits of twigs of the same much predominate. The twigs have usually thick leathery leaves and a dense durable epidermis. These facts indicate that the plants and parts of plants that can withstand long drifting are predominant, because more perishable forms were destroyed in transportation. Conifers of certain types are most common, probably because, under the existing conditions, they were best fitted for preservation, and not because they were most common in the flora. Plants fossilized after being drifted long distances can never give so correct an idea of the flora of the time as those that are entombed where they fell. It is greatly to be desired that near-shore formations of the epoch now in question containing fossil plants may be discovered. In that case the absence of types in the fossils would more probably indicate their absence in the flora.

While the conditions under which they were preserved indicate that the Glen Rose fossils probably give us a very imperfect idea of the flora of the time, the amount of material obtained is not large enough to give us much confidence in any negative conclusions concerning the character of the Trinity flora. To this must be added the fact that the plants are obtained from a single very small area in all the vast expanse of the Trinity beds. The collection was contained in five quite small boxes. The greater part of the material is in the form of duplicates of a few types, and this shows that Mr. Harvey obtained as full a representation as was possible of the forms found at the locality.

Prof. Robert T. Hill, of the U. S. Geological Survey, established the subdivisions of the Lower Cretaceous of Texas now generally accepted, after determining the true order of succession of the formations of that great state. He gives for the Lower Cretaceous the following groupings, the Comanche series forming the base of the Cretaceous:

Comanche Series.	III. Washita Division.	10. Denison beds.
		9. Fort Worth beds.
		8. Duck Creek beds.
		7. Schloenbachia beds.
	II. Comanche Peak or Fredricksburg Division.	6. Caprina limestone.
		5. Comanche Peak beds.
		4. Walnut clays.
		3. Paluxy sands.
	I. Trinity Division.	2. Glen Rose or alternating beds.
		1. Basal Trinity sands.

In a letter to the writer, Prof. Hill states that the Glen Rose fossil plants occur in a lenticular mass of fine sediment, in a chalky lime mass full of marine fossils, about 250 feet above the bottom of the Trinity Division. According to him, there is no break between the basal Trinity sands and the Glen Rose beds. The latter represent deposits laid down in deeper waters farther from land. The Trinity basal sands were formed as the sea advanced from its present outline across the whole state of Texas.

Attention may here be called to the similarity in the conditions attending the formation of the Trinity beds and the Potomac beds, as found in Virginia, which latter hold a fossil flora nearly allied, in its older elements, to that of the Trinity. The Potomac beds of Virginia (the lower Potomac) contain the fossil plants in lenticular beds of clay which lie in the sands and other coarse materials, the clay beds representing eddies in the unquiet waters. The Virginia Potomac sands and gravels were laid down in shallow shore waters, in a progressing subsidence. But in the case of the Virginia beds we have no evidence that the subsidence was sufficient to produce limestone.

DESCRIPTION OF THE SPECIES.

EQUISETACEÆ.

Equisetum texense sp. nov.

Pl. XXXVI, Fig. 1.

Stems small, 3 to 4 millimeters in diameter. Average length of internodes, 1 centimeter. Sheath swollen, average length, 5 millimeters. Character of teeth not certainly made out, but apparently they are narrow and about twelve in number. This Equisetum is much like *E. Burchardti*, Dunker, of the European Wealden, and resembles also *E. virginicum*, of the Potomac formation, but it seems to have been somewhat larger than the latter. It belongs to the type of Equiseta with small stems and swollen sheaths that is characteristic of the Lower Cretaceous. These three plants, *E. Burchardti*, *E. virginicum*, and *E. texense*, are all closely allied and are, perhaps, somewhat varying types of the same species.

Only one specimen was found that showed the sheaths, and in this case the preservation was not perfect enough to make fully known the shape of the teeth. There are, however, several imprints which appear to have been made by portions of the stem of this plant. The tumid character of the sheaths, however, is well displayed in the more perfect specimen. The considerable length of this stem, its rigid nature, and the appearance of the sheaths, remind one of Casuarina.

FERNS.

One of the most peculiar features of the flora collected at Glen Rose is the almost total absence of ferns. Generally in any collection of older Cretaceous fossils ferns are among the most abundant forms. As these Texas fossils are preserved in sediment accumulated during a progressing subsidence, we would expect them to show a large proportion of ferns. This, however, is not the case. Only a single imprint, with its reverse, was found belonging to this group, and this is the tip of a pinna or pinnule, which is too small to permit the character of the plant to be made out.

Sphenopteris valdensis Heer?

Pl. XXXVI, Fig. 2.

A small specimen was found of a fern of Wealden type, closely allied to, if not identical with, *S. valdensis*, described by Heer from the Wealden of Portugal. The specimen is too small to permit the positive determination of the plant. The fragment seems to belong to the terminal portion of an ultimate pinna. As this portion of a fern often differs much from parts lower down on the pinna, it is of no value to determine character. The pinnules or laciniæ have the narrow elongate shape, the oblique insertion, and the firm consistency given for *S. valdensis.* The nerves were not distinctly seen, but appear to be single in each lacinia or pinnule, as in the plant from Portugal. Heer* identifies his plant with *S. Jugleri*, Ettings, and with *Jeanpaulia nervosa* Dunk., of the Wealden of Hanover. This type of fern seems to have been a common one in the Wealden of Europe.

CYCADS.

The cycads, although not very abundant in the Glen Rose fossils, stand next to the conifers. They are in a very fragmentary condition, but still suffice to enable one to determine, in a number of cases, the character of the plant with some certainty. Fortunately the character of some of these forms is so marked that they are readily identified.

Dioonites Buchianus, var. **rarinervis** var. nov.

Pl. XXXVI, Figs. 3, 4.

This plant agrees in all respects, except the nerves, with the typical *Dioonites Buchianus.* It has the same thick durable epidermis, the same shape, dimensions, and mode of insertion of the leaflets, and the same character of stem. The nerves are stronger, fewer in number, and more remote than in the typical form so common in the Potomac of Virginia. They fork near the base of the leaflets, but have the ultimate branches only five to seven in number. Fig. 3 gives a portion of a leaf of medium size and shows the insertions of leaflets. Fig. 4 represents a terminal portion of a leaflet of large size showing the nerves. A considerable number (five to six) of specimens of this plant, were found, and if we may judge from this, it was one of the more common cycads of the Glen Rose region.

Dioonites Buchianus Schimper.

Pl. XXXVI, Fig. 5.

This plant, first found in the Carpathian Urgonian beds of Grodischt, and later seen to be distributed in great abundance in the Potomac strata of Virginia, was without doubt present in the Texas Trinity flora. It is, however, quite rare in the typical form as a fossil in the Glen Rose strata. At least two well characterized specimens of it, differing in no respect from the Virginia fossils, have been obtained. The specimens show the usual fine closely-placed nerves of the true *D. Buchianus,* covered with a firm durable epidermis. As I have endeavored in previous statements to show, no conclusion can be safely drawn from the rarity of the fossils as to the relative abundance of the form in the Trinity flora.

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* "Flore fossile du Portugal," p. 14, Pl. XV, Figs. 9–14.

Dioonites Buchianus, var. **angustifolius** Font

Pl. XXXVI, Fig. 6.

In the Potomac strata of Virginia a Dioonites was found with leaflets much narrower than the normal form. As it did not graduate into the normal *D. Buchianus*, and apparently was not an accidentally narrowed form of that species, the writer in Monograph XV of the publications of the U. S. Geological Survey, Part I, text, p. 185, proposed to consider it a variety. This narrow form is present in the Texas region, as is shown in one well characterized specimen. This specimen shows leaflets exactly like those of the Virginia Potomac.

Dioonites Dunkerianus (Göpp.) Miquel.

Pl. XXXVI. Fig. 12; Pl. XXXVII, Fig. I.

Leaves large; midrib very strong; leaflets spreading, closely placed, somewhat thickened at base, slightly and gradually narrowed toward their bases; attached to the sides of the midrib, as in *D. Buchianus*, with a slightly protracted and decurrent base, narrowly linear in shape, obtuse to subacute at the tips, very thick and leathery in substance, with a firm durable epidermis, attaining apparently maximum length of 15 centimeters and a width of 2 to 3 millimeters; nerves obscure, apparently five to six in number, very slender, and immersed in the thick leaf-substance.

Several fairly well preserved specimens of this noteworthy plant were obtained. They apparently belong to the middle and upper portions of the leaf, and the basal and terminal portions were not seen. The specimens are somewhat distorted, so that the angle made by the leaflets with the midrib can not certainly be made out. They seem to go off at an angle of about 45 degrees.

This plant agrees so well with *D. Dunkerianus* (Göpp.) Miquel, from the Wealden of Hanover, that it can not be separated from it. It clearly belongs to the same genus with *D. Buchianus*, wherever that may be placed, but is decidedly distinct from it. Schenk, in describing* *D. Dunkerianus*, gives the length of the leaflets as 4 to 4½ centimeters. I do not understand how he obtained these dimensions, for on Pl. XV, Fig. 1, of the same work he gives a figure of this plant which shows leaflets 7 centimeters long with the entire length not preserved. That they were considerably longer is shown by the fact that a leaflet 7 centimeters long, with the end broken off, shows no diminution in width. Schenk's figure represents the leaflets as they are shown in the Texas plant. Fig. 1, Pl. XXXVII of this paper, gives a portion of a large leaf with the leaflets of only one side preserved. All of the width of the midrib is not preserved, but its great size is indicated in the specimen. Pl. XXXVI, Fig. 12, gives a specimen with a smaller midrib, showing its entire width. In this latter specimen a number of the leaflets attached to the right-hand side of the midrib are doubled over to the left-hand side, so that with casual inspection they might give an erroneous idea of their mode of insertion. The texture of the plant figured by Schenk seems to have been similar to that of the Texas form, for both show a wrinkling at right angles with the length of the leaflets, due to shrinking in drying.

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* "Die Fossile Flora der Nordwestdeutschen Wealden formation," pp. 30, 31.

It is very difficult to see the nerves, as they appear to be very slender and are immersed in the leaf-substance. The contraction produced in the fleshy leaflets gives sometimes deceptive forms. In some cases two longitudinal folds, near the center of the leaflets, appear as strong nerves, and sometimes the space between them takes on the appearance of a strong single nerve, giving the plant the appearance of a Cycadites. At first I was led to think that the plant belonged to this genus. I am not then surprised that Dunker* described a form of this plant as *Cycadites Morrisianus*. Schenk correctly unites it with *D. Dunkerianus*, notwithstanding the fact that Dunker's figure represents the leaflets as nearly 8 centimeters long with the ends not preserved.

Podozamites acutifolius Font.?

Pl. XXXVI, Fig. 7.

Only a single specimen was found of a plant that may be identical with *Podozamites acutifolius* Font., of the Potomac formation. This is represented in Pl. XXXVI, Fig. 7. It is the basal portion of a small leaflet, narrowing to a pedicel at base. It has quite fine nerves that fork towards the base, the branches becoming parallel. The size of the leaflet and its shape towards the base agree quite well with the Potomac plant,† but of course the specimen does not permit positive identification.

It should be stated that both the species here given as Podozamites may belong to the genus Nageiopsis as determined by the writer‡ from the Potomac flora. There are no characters in the basal portions of single detached leaflets that will distinguish the two genera. The tips of detached leaflets, however, show distinctions, for in Podozamites the nerves towards the ends of the leaflets converge and unite more or less, while in Nageiopsis they continue parallel but are usually more closely placed towards the tips.

With reference to the genus Nageiopsis, it may be stated that when its determination was made from the study of the abundant material obtained from the Potomac beds of Virginia, the writer had not been able to see specimens of the leaves of the Nageia section of Podocarpus. Descriptions of the leaves were relied upon. Since that, owing to the kindness of a friend residing in Japan, both the leaves and fruit of forms of Nageia have been procured. The leaflets in every respect are identical with those of Nageiopsis, while the nut-like fruits closely resemble some of the smooth, rounded forms described in Monograph XV, as Cycadeospermum. It will be noted that similar fruits are found in the Glen Rose fossils.

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* "Monographie der Norddeutschen Wealdenbildung," p. 16. Pl. VII, Fig. 1.

† Monograph XV, U. S. Geological Survey, Part I, text, p. 181; Part II, plates, Pl. LXXXV, Fig. 10.

‡ Op. cit., Part I, text, p. 194–195.

Podozamites species?

Pl. XXXVI, Fig. 8.

A single specimen of the basal portion of a leaflet was found among the Glen Rose fossils, which seems to be a Podozamites. The leaflet narrows to the base, as if to form a pedicel. The nerves are strong, fork near the base, then become parallel. They are rather remote, and may belong to a form like *P. distantinervis* of the Potomac of Virginia, but the leaflets are much smaller than any shown by that species.

Zamites tenuinervis Font.

Pl. XXXVII, Figs. 3, 4; Pl. XXXVIII, Figs. 1, 2.

A considerable number of specimens were found of a cycad not to be distinguished from *Zamites tenuinervis* Font. of the Potomac of Virginia. This is by far the most common cycad in the Glen Rose fossils, and it is noteworthy that it is decidedly the most common Zamites in the Potomac flora. As is the case with the Potomac fossils, the leaflets are found detached, showing that they were easily separated from the stem, leaving a base with a sinus. The only difference between the Texas and Virginia forms is found in the fact that some of the Texas leaflets show nerves rather more remotely placed than those seen in any of the Potomac forms. The curving shape found in some of the Potomac fossils may be seen in some of the Glen Rose forms also. Fig. 4, Pl. XXXVII, may be compared with Fig. 1, Pl. LXX of Monograph XV of the United States Geological Survey. Pl. XXXVII, Fig. 3, of this paper gives the end of a leaflet; Fig. 2 shows a portion of one of the broadest leaflets, and Fig. 1, Pl. XXXVIII, represents portions of three leaflets that were apparently attached to the same stem. This plant is pretty well characterized, and as it seems to have been well established in the Trinity flora it is important as showing a resemblance between that and the Potomac flora.

CONIFERS.

Conifers are, as stated before, predominant forms in the Glen Rose fossils. They predominate in the number of species, and especially in the parts of certain forms capable of withstanding long immersion in water. The twigs of such plants as Frenelopsis, covered with a dense epidermis, and those of Brachyphyllum, protected by their imbricated dense leaves, the compact cones of Pagiophyllum, and the thick leathery leaves of *Sequoia pagiophylloides* are by far the most common fossils. The more fragile forms, like Sphenolepidium, Laricopsis, etc., are significant by their rarity. Owing to the fact that the parts of the plants were probably not covered with sediment as they fell, it is impossible to determine from the relative abundance of the fossils anything concerning the numerical relations of the plants in the flora.

Abietites Linkii (Roem.) Dunk.

Pl. XXXVII, Fig. 2.

The Glen Rose fossils furnish two or three specimens of a conifer that agrees closely with *Abietites Linkii* as described and figured by Schenk.* Schenk's figures represent detached leaves, but the Texas fossil is the end of an ultimate twig with several leaves attached. The exact mode of attachment of the leaves is not shown, but they, unlike the Cephalotaxopsis of the Potomac, a type somewhat similar to this, are scattered around the stem and taper gradually to their bases. The leaves are very rigid, coriaceous, linear in form, with obtuse tips. Only one good tip was seen, and the emarginate feature mentioned by Schenk was not observed. The midrib is single and strong. It is quite rare among the Glen Rose fossils.

Laricopsis longifolia Font.

Pl. XXXVI, Fig. 9.

A very distinctly defined imprint of a small cylindrical stem was found among the Glen Rose fossils. It has a distinct pitting, with small depressions that appear to be the scars of fallen leaves or leaf bundles. Attached to the stem which is proportionally very large, are the bases of several very narrow leaves. The leaves appear to have been threadlike. The stem and the leaves are exactly like some of those of *Laricopsis longifolia*, described by the writer from the Potomac of Virginia.† All the characters agree so well with those of the Potomac plant that, although the amount of the material is very small, I have no hesitation in regarding this Texas fossil as *L. longifolia*.

The nerves of the leaves could not be made out in the Glen Rose specimen, but there is nothing to indicate that they are not single in each leaf, as in the Potomac fossil.

Sphenolepidium Sternbergianum, var. **densifolium** Font

Pl. XXXVI, Fig. 10.

Several specimens of a conifer were found that appear to be identified with *Sphenolepidium Sternbergianum*, var. *densifolium*. This variety was determined by the writer from the Potomac of Virginia.

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* "Fossile Flora der Nordwestdeutschen Wealdenformation," pp. 39, 40. Pl. XIX, Figs. 1-5.

† Monograph XV, U. S. Geological Survey, Part I, text, p. 233. Compare of the same work, Part II, plates, Pl. CLXVIII, Fig. 5.

The leaves of the Glen Rose plant, especially the lateral ones, are narrow, acicular, and incurved, all closely crowded. The Texas plants agree exactly with some of the Virginia forms,* resembling most those with the most delicate and crowded leaves. Some of the specimens show undeveloped leafy buds, as may be seen in some of the Virginia forms.† The specimens are few, probably because the parts of this plant could not withstand long immersion in water and transportation to a distance.

Pinus species?

Pl. XXXVI, Fig. 11.

The collection of fossils from Glen Rose contains a few scattered, linear, one-nerved leaves, such as are shown in Pl. XXXVI, Fig. 11. They are more attached, and are always so broken that only short bits are visible, which never show the tips of the leaves. They have a width of about 1½ millimeters, and the longest specimens have a length of about 3 centimeters. Their deciduous character, narrow, rigid form, with only one nerve, indicate that they are a species of Pinus which can not be at present more accurately determined.

Brachyphyllum texense sp. nov.

Pl. XXXVIII, Figs. 3-5; Pl. XXXIX, Figs. 1, 1*a*.

Trees or shrubs with alternate and penultimate branches in one plane, spreading rather widely. The ultimate branches are usually formed by the dichotomous forking, at considerable intervals, of the penultimate ones, but they are sometimes sparsely distributed alternately towards the terminations of the latter. The ultimate branches are short, stout, cylindrical in form, obtuse, not tapered towards their tips. All the branches were covered with closely imbricated, leathery, thick, scale-like leaves, which had a dense, very durable epidermis that in its present condition looks like enamel. The leaves vary a little in shape with age. The young leaves are broadly elliptical, the older ones broadly rhombic, less commonly more or less rounded. Nearly all the leaves had their ends prolonged into the form of a subacute, lancet-shaped tip, which is usually incurved in the lateral leaves. They are strongly keeled towards their ends, and the keel runs back in the body of the leaf some distance, but does not pass to its base. The leaves are often decussate, in four rows, but are sometimes spirally arranged.

The probable cones are narrowly oval to oblong, about 1 centimeter in thickness and 2½ centimeters in length. The character of the scales of the cone was not made out. The probable staminate aments are oblong to cylindrical in form, covered with closely appressed and imbricated scales that are elliptical in shape and have at their ends acute prolongations that are about half as long as the body of the scale. These aments are about 13 millimeters long and 3 millimeters thick.

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* Compare Monograph XV, U. S. Geological Survey, Part II, plates, Pl. CXXXI, Fig. 3.

† *Ibid*, Pl. CXXXI, Fig. 1.

Numerous specimens of this noteworthy plant occur, and it was clearly very common in the Trinity flora. Unfortunately the thick coriaceous leaves have a great tendency to peel off from the stone, and hence specimens handled without great care are easily spoiled.

Pl. XXXVIII, Fig. 5, gives a portion of what was a branch of considerable size. It shows what seems to have been common in the plant, viz., the tendency of the twigs to diverge at first widely from the stems which give them off, and then to curve upwards toward the ends of the main branches. This figure shows also the dichotomous mode of division of the branches, which seems to have been the most common.

Pl. XXXIX, Fig. 1, represents the end of a compound branch that is much smaller than that given in Fig. 5, which is the middle portion of the branch.

In Pl. XXXIX, Fig. 1, the arrangement of the ultimate twigs in an alternate manner, a less common mode, is seen. Some of the ultimate twigs in this specimen were broken off, so that the ultimate grouping is not fully shown. The only cone found which can with probability be referred to this Brachyphyllum is that given in Fig. 3, Pl. III. As the stone in splitting carried off the upper surface of this cone the character of the scales was not made out, while its dimensions and shape are well disclosed. The scales seem to have been rather thick toward their free ends, wedge-shaped towards their base, and to have overlapped one another.

The small ament represented in Pl. XXXVIII, Fig. 4, most probably belongs to this Brachyphyllum, being the staminate ament. The shape of its scales agrees well with those figured by Saporta* for *B. gracile*, but the ament from Texas is more slender or cylindrical in shape.

This plant is most probably a new species. It is probably nearer *B. Moreauanum* Brongn., than any previously described species, but differs from this in the greater uniformity in the shape of the leaves, and in the constant absence of any mammillary prominence on their backs as well as in the more decided development of a lancet shaped tip.

It is quite different from *B. crassicaule* Font., of the Virginia Potomac† in showing a more sparse dichotomous branching, in the distinct keel, in the denser epidermis of the leaves, and in their prolongation at their tips.

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*Paléontologie Française. Plantes jurassiques. Tome III: atlas, Pl. XLIII, Fig. 7.

†Monograph XV, U. S. Geological Survey, Part I, text, p. 221.

Pagiophyllum dubium sp. nov.

Pl. xxxix, Figs. 2–11.

Tree or shrub, with the penultimate and ultimate twigs, which alone were seen, rigid, cylindrical, and quite thick. The leaves are slightly imbricated, or overlap by their tips, which are thin and parchment-like, while their bases are considerably thickened. They are closely appressed to the surface of the twigs, and show no keel or prominence of any kind. They vary much in shape, being broadly triangular or broadly elliptical, sometimes rounded subquadrilateral. All are very obtuse and rounded at their tips, and have their greatest dimensions transverse to the axis of the twig. The epidermis is thin, but apparently quite durable, and the outer surface of the leaves is marked by lines of pits which are distinctly visible to the unassisted eye, the lines converging toward the tips of the leaves, and being approximately parallel to their margins. These imprints are exactly like those seen on the epidermis of Frenelopsis, which is strikingly like that of the plant now in question. The cones, single or in pairs, at the end of short, very stout ultimate branches, are small and globular in form, the largest seen being about 15^{mm} in diameter, and the smallest 8^{mm}. The cone-bearing branches have, next under the cones, leaves of different character from the normal ones. They resemble much abbreviated points of *Frenelopsis varians*. They vary in shape from the normal kinds to those in which the edges of the leaves appear as transverse lines more or less convex upwards, and concave downward, only one rank of leaves appearing on the anterior surface of the stem.

The scales of the cones are closely appressed, small, numerous, spirally arranged, thickened at the free ends, prolonged into an incurving spiny beak like that of Araucaria. The beak being removed leaves a scar not unlike that of Araucaria, being a rhombic-shaped depression, much elongated transversely.

The scales of the cones, when wholly removed, as they generally are, leave imprints that are in shape subrhombic to broadly elliptical, and prolonged at the tips to a more or less acute point.

This remarkable conifer is the most common fossil at the Glen Rose locality. The twigs are not specially abundant, but the cones are very numerous, being much the most abundant fossil. They were borne on the summit of stout ultimate twigs, that generally broke off a little below the base of the cone, so that usually a short piece of the twig is found with each cone. Owing to the fact that the exterior of the fossils at Glen Rose is generally removed in breaking the stone, these portions of the twigs attached to the cones do not often show the character of the leaves. Still a considerable number of specimens are found with a few of the leaves pretty well preserved. Unfortunately none of the twigs attached to cones are long enough to show more than three or four leaves. Hence the character of the leaves on more remote portions of the cone-bearing twigs was never seen, and the gradations of the abnormal leaves next to the cones into normal ones could never be traced on the same twig. But on comparing a number of these twigs it can be seen that there is a complete transition from the most abnormal forms to the normal ones. The leaves on most of the twigs next to the cones are so much like very much shortened internodes of *Frenelopsis varians* that for a long time I thought that the cones belonged to that species. This supposition was confirmed by the fact that this Frenelopsis has, in a number of cases, nodes on the stems that are much shortened. The likeness to Frenelopsis is increased by the presence of the lines of stomata, which much resemble those of that plant, and by the texture of the epidermis, which is similar to that of Frenelopsis.

The vegetable matter of the twigs of this plant is generally in the condition of a powder, inclosed in a shell composed of epidermal tissue. On breaking the stone the whole of the material crumbles away, and the exterior shell, showing the shape of the leaves, is especially prone to be destroyed. On this account it is very difficult to preserve specimens with leaves. Where the thin free tips of the leaves overlap on the thickened bases of those next above, pressure often produces the imprint of a line, so that some hint is thus given of the shape of the leaves. The imprints thus formed, however, do not give their true shapes, as the overlapping ends are not shown. Pl. XXXIX, Fig. 2, gives the shapes produced by these lines, and it will serve also to indicate the stoutness of the twigs, the one represented here being a penultimate one.

The leaves were proportionally very large, and of the general form of those of Brachyphyllum, but they do not possess the thick enamel-like epidermis of that plant. They have their basal portions thickened, and show very distinct rows of stomata. In these features they are allied to Pagiophyllum (Pachyphyllum) more closely than to any other previously described conifer, and on this account I have, with much doubt, placed the plant in that genus, indicating its doubtful position by the specific name given it. It is quite probable that the plant is the type of a new genus, nearly allied to Araucaria, and uniting in itself with features of Araucaria, some of those of Brachyphyllum and Pagiophyllum. The type seems to differ from Pagiophyllum chiefly in the form of the leaves. *Pagiophyllum* (*Pachyphyllum*) *cirinicum*, as described by Saporta,* agrees in its leaves on some of the larger twigs with this, but other forms of this species† have quite different leaves.

Indeed, the genus Pachyphyllum, renamed by Heer Pagiophyllum, although it can hardly be considered as sharply defined, has, as the more common form of leaf, one quite different from any shown in the plant now in question. While some leaves, as given by Saporta, have tranversely elongated, more or less rounded, or rhombic forms, they mostly appear with elliptic or rhombic shapes, elongated in the direction of the axis of the stem, with a considerable portion free, more or less remote from the stem, often incurving, with the whole leaf much thickened. This Texas plant does not have these features.

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* Paleontologie Française, Plantes jurassiques, Tome III, Pl. LIII, Fig. 1.

† Ibid., Pl. LIV, Figs. 1-3.

The leaves of *P. dubium* are very large in proportion to the diameter of the twigs, so that a single leaf often extends across the whole upper surface of the stem, as is shown in Pl. XXXIX, Figs. 3 and 4, which represent their more common forms. The cones are nearly always single, at the tips of short, stout twigs, but Pl. XXXIX, Fig. 5 gives a pair of cones, which appear at the summit of the twig. The shape and size of the cones of this plant remind one strongly of those of Sequoia. The resemblance is increased when the cone scales are retained, but have lost their beak like projections. This sort of cone is shown in Pl. XXXIX, Fig. 6. Plate XXXIX, Fig. 7, shows the dimensions of one of the largest cones, and also the character of the imprints left when the cone scales are removed. This cone shows, at the summit of the twig which bears it, abbreviated leaves, such as are represented in Pl. XXXIX, Fig. 8, other cone-bearing twigs have such leaves as are given in Pl. XXXIX, Fig. 9. Figures 8 and 9 give magnified portions of the twigs. Plate XXXIX, Fig. 10 gives several leaves considerably magnified to show the lines of stomata. Plate XXXIX, Fig. 11 gives a twig to which a short cone-bearing twig is attached.

Frenelopsis varians sp. nov.

Pl. XL, Figs. 1–2; Pl. XLI, Figs. 1–3*a*.

Tree or shrub with penultimate and ultimate branches alone obtained. These were originally quite long, succulent, and cylindrical, with joints of varying length. The ultimate twigs seem to have played the part of leaves. The largest penultimate branches have a very small woody axis; the ultimate ones usually show little or no woody tissue. All the branches found fossil appear as flat, ribbon-shaped strips of vegetable matter, composed almost wholly of parchment-like, very durable, epidermal tissue, cut at varying intervals by lines of constriction which represent the nodes. The twigs are very prone to break at these nodes, hence they usually present the form of fragments without preservation of their summits and bases. The epidermis is marked by lines of dot-like imprints, which are not distinctly visible without the help of a lens. The internodes vary much in length and often irregularly, especially in the ultimate twigs. They sometimes appear uniformly short jointed, and then are exactly like *F. parceramosa*[*] of the Potomac formation of Virginia, and from this cause I at first thought it identical with that plant. This uniformly short jointed form is shown in Pl. XLI, Fig. 2. The most common form, however, shows internodes or joints averaging about 15 millimeters in length, except towards the base of the ultimate twigs, where, near their attachment to the penultimate twigs, they uniformly are much shortened, being 7 or 8 millimeters or less in length. These forms, which we may regard as the normal ones, have an average width for the joints of about 6 millimeters. This normal form is represented by Pl. XLI, Fig. 3. Other specimens, however, show great irregularity, the joints varying in length according to no rule, normal joints and short ones being intermixed. This is seen in Pl. XL, Fig. 1, especially in the right lower ultimate twig. The dimensions of the ultimate and penultimate twigs do not vary much. The ultimate twigs must, in some cases, have attained a considerable length, for fragments were seen 16 centimeters long, which did not have the ends preserved and did not show any marked diminution in diameter. The largest twig seen is a mere fragment, and is shown in Pl. XLI, Fig. 1. This shows the largest woody axis, for this axis appears to conform in size to the dimensions of the twig. The ultimate twigs seem to have been in their attachment to the ultimate ones rather remote and scattered around them. Some short twigs were found which seem to have been undeveloped ultimate twigs. One of these is represented in Pl. XL, Fig. 2. These forms show abbreviated nodes which strikingly resemble the leaves at the summit of the cone-bearing twigs of *Pagiophyllum dubium*.

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[*] Monograph XV, U. S. Geological Survey, Part I, text, pp. 218–220.

The leaves are almost always undeveloped. The summits of the joints which should show the leaves, if they were present, almost always appear as a line of constriction which has various attitudes. It may run at right angles to the axis of the twig, or be inclined to it, in both cases being nearly straight. In other cases, and these are common, the constriction may be convex upwards or concave downward. These succeed one another in such order as to indicate that the ends of the joints bear undeveloped teeth or leaves of triangular type. In a very few cases there are very slightly developed teeth or leaves, which have the form of very broad, low triangles. This is shown in the form given in Pl. XLI, Fig. 3, where the right-hand lower ultimate twig, on the summit of the third joint from the attachment, shows a leaf of this kind.

The almost universal absence of developed leaves is one of the most important points of difference between this plant and *F. parceramosa*, for in this latter visible leaves are quite common, and of the character of those occurring with extreme variety in the Texas plant. It should be noted, however, that in the Potomac fossil a number of specimens show only the lines of constriction, as in the case of *F. varians*. The leaves when present appear to be one at the summit of each joint. While the Texas plant is most probably specifically distinct from *F. parceramosa*, it is very near to it, being nearer than to *F. Hoheneggeri* Schenk, of the Urgonian of Europe. This latter seems to be intermediate in type between *F. ramosissima** of the Potomac formation and *F. parceramosa*, since it has the considerable development of woody tissue, and the whorls of three leaves on the joints, possessed by the former, with the character of jointing and general aspect of the latter.

It is interesting to note that *F. parceramosa* occurs in the Potomac formation of Virginia in only one locality† in company with plants of a type strikingly like those associated with the Texas species. This locality is the "Entrance to Trent's Reach," on James River, where *Dioonites Buchianus*, *Brachyphyllum crassicaule*, *Williamsonia virginiensis*, etc., are also found. *Baieropsis pluripartita* was found at this locality, and it is probable that it will yet be found to exist in the Trinity flora.

F. varians is one of the most common fossils in the Glen Rose collection.

Frenelopsis Hoheneggeri (Ett.) Schenk.

Pl. XLII, Figs. 4, 4*a*.

The specimen given in Pl. XLII, Fig. 4, is the only one of the kind that was found in the Glen Rose fossils. It has all the characters of Schenk's plant, and differs decidedly from the numerous specimens of *F. varians*, among which it was found.

The specimens of *F. varians* are black in color, while this is brown. The twigs have a larger woody axis than that found in the more common plant. The tubercles are larger, so that the lines formed by them are distinctly seen with the unassisted eye, which is not the case with *F. varians*, and the general aspect of the twigs is more rigid. But more important than these features is the fact that the summits of all the joints bear distinctly developed leaves. These have the characters seen in *F. parceramosa* and *F. Hoheneggeri*, i. e., they are short and triangular in form. They differ from those of the former plant, and agree with those of the latter in the important feature that they occur in whorls of three. Two of these leaves occur on the upper face of the lowest joint of the specimen, and are represented in Pl. VII, Fig. 4*a*, which gives a portion of the stem enlarged to show the character of the leaves. The leaves alternate in position in the successive whorls, and resemble clearly those given by Schenk for *F. Hoheneggeri*.‡ The figure of this plant, given (Pl. VI, Fig. 1) in Schenk's work, shows on the second ultimate twig attached to the main stem on the left-hand side, counting from the bottom of the figure, a single triangular leaf, and on the joint next above these are two leaves of the same character that alternate in position with the one below. On the joint above these there is again a single leaf. This shows that the leaves of *F. Hohenegg-*

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* Monograph XV, U. S. Geological Survey, Part I, text, pp. 215–218.

† Ibid., p. 220.

‡ "Die fossilen Pflanzen der Wernsdorfer Schichten." Pl. VI, Fig. 1.

geri occur, alternately in whorls of three. They, as given in this figure, agree exactly with those of the Texas plant.

On the specimen of the plant found at Glen Rose the epidermal tissues on nearly all the joints is too poorly preserved to show fully the leaves, but enough is preserved to indicate clearly that the plant has the character given above.

This Texas specimen has the rigid aspect which is characteristic of *F. Hohenggeri*. It has much more woody tissue than larger specimens of *F. varians*, and shows no short joints.

Sequoia pagiophylloides sp. nov.

Pl. XLII, Figs. 1-3*a*.

Tree or shrub with the penultimate and ultimate branches spreading in one plane, the latter alternate in position. Leaves on the older branches spirally arranged so as to appear as facial and lateral in position. The facial leaves are inconspicuous, sparsely scattered, closely appressed to the stem, and much smaller than the lateral ones. They are lancet shaped or elliptical, rounded at the tips, and very obtuse, with no keel or midrib. The lateral leaves are much larger and form the only conspicuous ones. They are, as now presented, oval or triangular in shape, rather remote, with a much broader base, strongly decurrent, and stand nearly at right angles with the axis of the twig. They are very obtuse at the summit, and are slightly falcate in their upper portion. The leaf substance is very thick and is covered with a dense, firm, and durable epidermis. They have a distinct keel or midrib, which toward the summit is much attenuated, but toward the base is widened, so as to assume a triangular form. The younger twigs show only lateral leaves, which are similar to those on the older ones. The probable staminate aments, of which only one specimen was found, occur on a common stem arranged alternately. They are very small, being club or pear shaped, with a maximum thickness at the summit of about 2 millimeters, and a length of about 3 millimeters. They are not preserved well enough to show the details of structure, but appear to be covered with thin, rounded scales. That they belong to this plant is shown by the presence of a normal lateral leaf between two of the aments, the two lowest on the left hand side.

Fig. 1, Pl. XLII, shows one of the most complete branches of this plant that was found, and Fig. 1*a* gives a magnified portion of the main stem of this specimen to show the facial leaves. These do not generally appear, as they are destroyed in splitting the stone by the peeling off of the epidermis. Pl. XLII, Fig. 2, gives a specimen with lateral leaves of the largest size, and which shows no facial leaves. Fig. 2*a* gives a portion of this enlarged to show the character of the lateral leaves. Fig. 3, Pl. XLII, gives the group of aments of natural size, and Fig. 3*a* gives a portion of it enlarged to show the normal lateral leaf.

This fossil is one of the most common ones at Glen Rose. This is no doubt accounted for by the very durable character of the epidermal tissue and the thick character of the leaves. They are very prone to peel off from the stones and leave only an imprint. The lateral leaves appear now as a leathery material, composed mainly of the epidermis. This has in the center a sharply defined keel, that looks like a pucker in the leaf substance, rather than a bundle of woody tissue forming a true midnerve. The keel, however, is probably determined by the presence of such a midnerve influencing the shrinking of the leaf tissue in drying. No vascular bundle, however, was distinctly seen, and in this respect the leaves differ from those of Sequoia, and resemble more those of Pagiophyllum. It is difficult to determine from the present aspect of the leaves what was their character when living. They, however, give strong indications that they were much thickened towards their bases, so as to have a pyramidal form, and they probably had a distinct keel, so that their cross section would be rhombic in form. This again is a character of Pagiophyllum and not of Sequoia. But in Pagiophyllum, as a rule, the facial leaves are numerous and as conspicuous as the lateral ones, while in this plant they do not appear at all on the ultimate and youngest twigs, and on the older ones they are so few, small, and closely oppressed that they are not visible unless carefully looked for. It was only after prolonged search that I found a specimen showing them. It is true that allowance must be made for the greater liability of the facial leaves to be destroyed in splitting the stone, but a number of specimens showed the outer surfaces of the ultimate twigs well preserved, and in no case were facial leaves shown even in traces.

I have with great hesitation placed this plant among the Sequoias, to which it has, in general facies, a strong resemblance. It shows a blending of the features of that genus and of Pagiophyllum, and is probably a new genus with composite character, as is the case with the peculiar *Pagiophyllum dubium*. The data at hand, however, do not suffice to fix with certainty its true character, and it may be provisionally regarded as a Sequoia. The large angle that the lateral leaves make with the stem is totally unlike Pagiophyllum, and more resembles Sequoia, although no previously described species of this genus known to me has leaves standing so nearly at right angles with the stem. *Sequoia ambigua* is nearest to it, but its leaves have a distinct vascular midnerve, are much thinner in texture, and more acute, while they go off more obliquely.

Abietites species?

Pl. XLIII, Fig. 4.

This undetermined cone is too fragmentary to permit its character to be made out, but enough is preserved to show that it was considerably larger than any of those of Brachyphyllum and *Pagiophyllum dubium*. The axis is thick and woody, the scales appear to have been long and wedge-shaped, thin at their lower ends and thickened at their upper ends.

The cone seems to have been broadly elliptical in form, about 2½ centimeters long and 2 centimeters thick. The stout stem, still attached to the base of the cone, does not show any of its external surface, so that the leaves can not be made out. In size and shape it reminds one of *Abietites angusticarpus* of the Potomac of Virginia.*

PLANTS OF UNCERTAIN AFFINITY.

Williamsonia texana sp. nov.

Pl. XLIII, Figs. 1, 2.

The bracts are arranged in two alternating whorls, four or five in each whorl, at the summit of apparently a large woody stem. They are lancet shaped to narrowly ovate, about 15 millimeters long and 4 millimeters wide in the widest portion, smooth, and with no nerves apparent. Plate XLIII, Fig. 1, shows some of the leaves at the summit of a small stem. Plate XLIII, Fig. 2, shows a portion of both whorls somewhat contorted, while the stem is only partially given.

This is apparently a new species of Williamsonia. It differs from *W. virginiensis* of the Potomac of Virginia† in being smaller, thinner in texture, smoother, and in not showing hairs. The shape of the bracts is similar to that of the two forms given by Schenk as found in the Wernsdorf beds,‡ and which he thinks are the male inflorescence of some cycad, but the stem of the latter, especially its summit, is quite different. This adds another to the similar types of plants found at Glen Rose and the entrance to Trent's Reach in Virginia.

Carpolithus obovatus sp. nov.

Pl. XLIII, Fig. 5.

Several specimens were found. This seed is somewhat altered from maceration. It shows pretty strong ridges, but has been decorticated, so that its original exterior can not now be made out. There appears at its lower end an indication that it was attached to a strong stem. It has an obovate shape, being widest near the summit, where it seems to have borne a short beak. In the widest portion it measures 14 millimeters, while the length is 3 centimeters. It seems to have had a large amount of woody tissue.

Carpolithus Harveyi sp. nov.

Pl. XLIII, Fig. 3.

Only one specimen was found. The seed seems to have had a smooth surface and a large amount of woody tissue, so that the entire form is now preserved in lignite. Its shape is elliptical, with one margin more convex than the other. In the widest part it measures 13 millimeters, while the length equals 2½ centimeters. It is very much like *C. curvatus** of the Virginia Potomac, the only difference being that it is not so much curved as that. Named for Mr. J. W. Harvey, the collector.

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*See Monograph XV, U. S. Geological Survey, Part II, plates, Pl. CXXXIII, Fig. 1.

†Monograph XV, U. S. Geological Survey, Part I, text, p. 273; Part II, plates, Pl. CXXXIII, Figs. 5-7; Pl. CLXX, Fig. 5.

‡Die fossilen Pflanzen der Wernsdorfer Schichten, Pl. V, Figs. 3, 4.

Cycadeospermum rotundatum Font.

Pl. XLIII, Fig. 6.

Several specimens of this were seen. The seed was spherical in form and covered with a smooth parchment-like durable epidermis, which looks like brown enamel, and is often all that is preserved. It is about 8 millimeters in diameter. It is exactly like the seed of the same name found in the Potomac of Virginia,† but is more strictly globular in form, a difference that is probably due to different effects of pressure.

AGE AND AFFINITIES OF THE TRINITY FLORA.

A typical Mesozoic flora is composed of only four elements. These are ferns, cycads, conifers, and equiseta. The flora of this type seems to have reached its culmination in the Jurassic, but many of its plants were continued with diminishing numbers through the Lower Cretaceous, ending with that epoch. The Wealden of different parts of the world appears to have been the fresh-water and marsh equivalent of the lower portion of the Neocomian, which, in its typical development, represents the marine deposits of the Lower Cretaceous. The typical Wealden contains no element in addition to the four given above, but the lower Potomac formation, as seen in Virginia, appears to coincide in age with the greater part of the Neocomian, and this gives us, so far as is yet known, the first appearance of angiosperms. The older portion of the lower Potomac contains, with a great predominance of Jurassic types, a number of old forms of angiosperms, such as Ficophyllum, Proteaephyllum, Rogersia, etc. In the upper beds of the same angiosperms become more abundant and they are more modern in type, while the Jurassic element is much diminished. The plants found at Glen Rose, show, so far as can be judged from so imperfect a collection, that the Trinity flora finds its closest resemblance in the older portion of the lower Potomac. There is, however, this important difference: No trace of angiosperms, even the most archaic, has been found in the Texas region. We have only the four elements of the typical Jurassic flora. This then makes the Trinity flora somewhat older than that of the oldest Potomac. The absence of the angiosperms and the presence of the forms that are found indicate decidedly that the Trinity flora is not younger than the earliest stage of the Cretaceous. The number of plants found to be identical with certain of those of the oldest Potomac shows that there is little difference in the age of the two formations. The plant-bearing portion of the Trinity is somewhat older than the basal Potomac strata, but the difference in age can not be great.

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* Monograph XV, U. S. Geological Survey, Part I, text, p. 269; Part II, plates, Pl. CXXXV, Fig. 17.

† Monograph XV, U. S. Geological Survey, Part I, text, p. 271; Part II, plates, Pl. CXXXVI, Fig. 12.

There can be little doubt that additional collections from the Trinity strata will show at least some of the older forms of angiosperms found in the Potomac, but at present they are not known to exist. It will be convenient, for the purpose of comparison, to give in the form of a table the plants found at Glen Rose. In it the plants will be placed in the formations in which they have been previously found, and where similar, but not identical, species have been previously known they will be indicated in the proper formation. In the first column the peculiar species, or those that occur only at Glen Rose, will be placed.

Table of Glen Rose fossils.

Name.	Peculiar species.	Occurring in the Potomac formation.	Occurring in the Wealden formation.	Occurring in the Urgonian formation.
1. Equisetum texense	......	Near Equisetum virginicum.		
2. Sphenopteris valdensis?	......	......	+	
3. Dioonites Buchianus var. rarinervis	......	Near Dioonites Buchianus.	......	Near Dioonites Buchianus
4. Dioonites Buchianus	......	+	......	+
5. Dioonites Buchianus var. angustifolius	......	+	+	
6. Dioonites Dunkerianus	......	......	+	
7. Podozamites acutifolius	......	+		
8. Podozamites species?	......	Near Podozamites distantinervis.		
9. Zamites tenuinervis	......	+		
10. Abietites Linkii	......	......	+	
11. Laricopsis longifolia	......	+		
12. Sphenolepidium Sternbergianum, var. densifolium.	......	+		
13. Pinus species?	+			
14 Brachyphyllum texense	......	Near Brachyphyllum crassicaule.		
15. Pagiophyllum dubium	+			
16. Frenelopsis varians.		Near Frenelopsis parceramosa.		
17. Frenelopsis Hoheneggeri.	......	......	......	+
18. Sequoia pagiophylloides	+			
19. Abietites? species	+			
20. Williamsonia texana	+			
21. Carpolithus obovatus	+			
22. Carpolithus Harveyi	......	Near Carpolithus curvatus.		
23. Cycadeospermum rotundatum	......	+		
	6	6 similar. 7 identical.	4	1 similar. 2 identical.

From this table it will be seen that all the species of the Glen Rose fossils hitherto found occur in the Lower Cretaceous, ranging from the Wealden to the Urgonian. The Potomac includes both these epochs. Some of the fossils from Glen Rose have no value for the fixing of the age of the flora because they are not sufficiently well characterized. Of such a nature are *Sphenopteris valdensis* ?, the undetermined species of Podozamites, the species of Pinus, and the undetermined cone. Omitting these, we have nineteen species. Four of these are peculiar species, and they of course can not be taken into consideration when the Trinity fossils are compared with known plants. Of the fifteen remaining, no less than twelve are identical with plants from the older Potomac, or are so near them that a strong presumption of the nearness in age of the two formations is established. The circumstances under which the basal Trinity beds were laid down indicate that the fossils entombed in them form a portion of a flora that was established on the land that was enroached upon by the Trinity sea. It is probable that this same flora extended northward to Virginia, where, somewhat later, it was preserved by a similar encroachment.

The Glen Rose, or alternating strata, in which the fossil plants are found, contain an abundant marine fauna, from the evidence of which Prof. Hill had concluded that its age is Neocomian, or basal Cretaceous. No fossil plants had been hitherto found in the Comanche series, and the evidence of its age was derived wholly from the animal remains. The discovery of plants in it was then of special importance, for it enabled us to compare the evidence of the plant life with that of the animal life. It is interesting to find so close an agreement. This agreement adds one more proof of the value of fossil floras in fixing the age of the strata in which they are found.

EXPLANATION OF PLATES.

PLATE XXXVI.

Fig. 1. *Equisetum texense* sp. nov.
Fig. 2. *Sphenopteris valdensis* Heer.?
Figs. 3, 4. *Dioonites Buchianus*, var. *rarinervis* var. nov.
Fig. 5. *Dioonites Buchianus* Schimper.
Fig. 6. *Dioonites Buchianus* var. *angustifolius* Font.
Fig. 7. *Podozamites acutifolius* Font.?
Fig. 8. *Podozamites* sp.?
Fig. 9. *Laricopsis longifolia* Font.
Fig. 10. *Sphenolepidium Sternbergianum* var. *densifolium* Font.
Fig. 11. *Pinus* sp.?
Fig. 12. *Dioonites Dunkerianus* (Göpp.) Miquel.

PLATE XXXVII.

Fig. 1. *Doonites Dunkerianus* (Göpp.) Miquel.
Fig. 2. *Abietites Linkii* (Roem.) Dunk.
Fig. 3, 4. *Zamites tenuinervis* Font.

PLATE XXXVIII.

Fig. 1, 2. *Zamites tenuinervis* Font.
Figs. 3–5. *Brachyphyllum texense* sp. nov.

PLATE XXXIX.

Fig. 1, 1*a*. *Brachyphyllum texense* sp. nov.
Figs. 2–11. *Pagiophyllum dubium* sp. nov.

PLATE XL.

Figs. 1, 2. *Frenelopsis varians* sp. nov.

PLATE XLI.

Figs. 1–3a. *Frenelopsis varians* sp. nov.

PLATE XLII.

Figs. 1–3a. *Sequoia pagiophylloides* sp. nov.
Figs. 4, 4a. *Frenelopsis Hoheneggeri* (Ett.) Schenk.

PLATE XLIII.

Figs. 1, 2. *Williamsonia texana* sp. nov.
Fig. 3. *Carpolithes Harveyi* sp. nov.
Fig. 4. *Abietites* sp. ?
Fig. 5. *Carpolithes obovatus* sp. nov.
Fig. 6. *Cycadeospermum rotundatum* Font.